



Automating a manual process with an RPA for BBVA CIB

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Abstract

This thesis aims to analyze, design, and develop a system to automate a specific manual process by implementing 'Robotic process automation' within the BBVA bank. This automation will allow the person in charge of the function to reduce the time and effort they spend daily to complete the tasks by fulfilling it for them. The design of this system is based on different views and viewpoints. The implementation of the software has been developed around the RPA TagUI while the programming language is Python.

Keywords: Robotic process automation, view and viewpoints, Software development, Automatize

Introduction

A software development lifecycle process is a type of framework used to develop any kind of software product. Many models could be used, such as the Waterfall model, Spiral model, Prototyping model, Agile model, and quite a few more. The development steps or the activities may vary, but all models involve the phases of requirements, design, development, testing, deployment, and review. However, some models like Agile and Prototyping involve an incremental approach in a specific design or development phase.

It is crucial to point out that designing the product to fulfill the user's requirements is a critical aspect of the development process. Without it, some requirements may be forgotten, or they may not be accurate on how the user will want them to be. By using the Prototyping model, these errors could be minimized since the user will provide feedback after the version has been present.

This document's primary purpose will be to demonstrate the steps taken in designing the software, which will automate the manual process of validating the files uploaded by the Money Market into the Superfinanciera's database. As it currently stands at the BBVA, this process could take between 30- 45 minutes per day, not considering the human error, making it rise to an hour. Automating this specific process will allow the bank to find that it can be more efficient to mitigate human errors from its end while also reducing times drastically, allowing the employee to focus on another task in the meantime. This automation can be done by completing the functional and non-functional requirements to ensure the entire software's usability and effectiveness. The architecture that will be defined shall meet the business expectations while validating that the proposed design will ensure that the process is efficient.

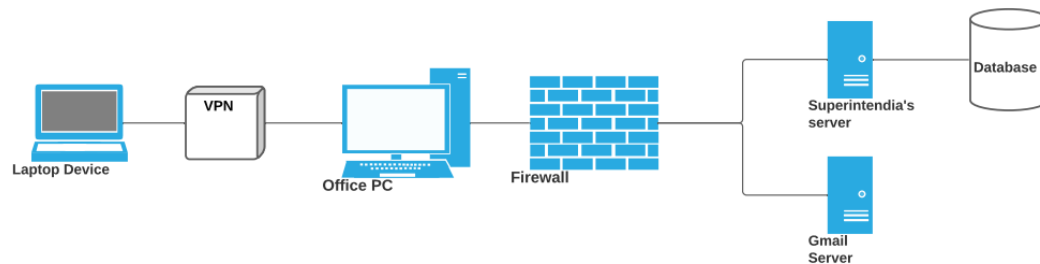
There is a special note stating that the document will not have any sensitive information, including any prototype or demos that will involve software development due to the bank policies. However, the design of the software will be provided due to educational purposes.

1. Problem statement

2.2 Problem description

At the very moment, the BBVA is manually verifying files uploaded into the Superintendencia database by the Money Market department. This manual process is prone to human error and takes quite a bit of time to validate each file uploaded on a specific date. The time expended daily to realize this task is between 30 – 40 minutes, which is entirely inefficient.

Figure 1 Normal Process



Author: Juan Cortes

Problem formulation

The BBVA is a multinational bank that is always trying to find the most efficient way possible for its processes. One area of opportunity that could be optimized would be automatizing the manual process of validating the files uploaded by the money market. It is a vital process within the department that should be prone to human error and possible inefficiencies.

2.2 Research question

By considering the manual process that is being done within the money market, could it be possible to increase the efficiency and reduce the errors being committed by the employees while undergoing digital transformation to restructure the design of the software currently being used?

2. Objectives

2.1 General Objective

Automate the validation of the files uploaded by the money market department to reduce existing inefficiencies by designing a software whose purpose is to support the function.

2.2 Specific Objectives

- Define Functional and non-functional requirements to ensure the usability and effectiveness of the entire software by completing the user stories.
- Define a software architecture to meet the business expectations by using points of view and views as a reference model.
- Validate the proposed design to ensure that the process is efficient by developing a proof of concept.

3. General Framework

3.1 Theoretical framework

Overview of BBVA

BBVA is a customer-focused worldwide financial services group founded in 1857 in northern Spain¹, where it started as an issuance and discount bank. In 1978, it was restructured as a loan and discount bank since it lost its right to issue its proper banknotes. Around 1901, it carried out its first transactions in Bilbao and slowly started to expand its way throughout Spain. After expanding by acquiring different banks around the 1960s, it grew and established itself as a modern, universal bank and an influential financial group. Throughout the 1980s, the group had gone through massive changes that it decided to merge Banco de Bilbao and Banco Vizcaya to create one entity, BBVA. On October 19, 1999, to continue adding value, BBVA and the brand Argentaria decided to announce their merger, creating the bank now known as BBVA.²

As of December 2019, it has 78.1 million customers, with more than 126,973 employees, and 699 billion euros in total assets, taking the rank as number 42 out of the top 100 banks globally. To ensure that the group's transformation and achievement accelerate and deepen, BBVA has taken its strategy and merged it with six strategic priorities:

¹ (BBVA 2019)

² (BBVA 2019)

1. Improve clients' financial health
2. Helping the client's transition towards a sustainable future
3. Reaching more clients
4. Driving operational excellence
5. The best and most engaged team
6. Data and Technology

BBVA CIB

The BBVA CIB is designated to offer a wide range of value-added products and solutions for the most precise and most complex needs. Every client is at the center of the BBVA CIB strategy, which intends to have full coverage by having the appropriate segmentation and industry expertise; This is done by having coverage teams in all geographies coordinated by groups coordinated by teams specialized operating the product. Additionally, the strategy also contemplates the idea of giving the clients the best client service available thru cross-selling opportunities, revenue diversification, coordination of client interaction via a Client Service Team and having a presence in the e-commerce channels.

3.1.1 Derivatives

The financial exchange system has been transformed by the concept of derivatives, not only in the past couple of years but also a few decades ago. A financial derivative could be defined as a security whose value depends on the amount of more basic underlying variables, like the prices of other traded securities, interest rates, commodity prices, or stock indices.³ Two or more parties can negotiate a derivative; this depends on the personal interest of each holder, who may consider dealing with another entity. The benefit that each investor can gain from agreeing to a derivative is to either mitigate risk or assume risk with the expectation of commensurate reward.

³ (Kwok, 2010)

The BBVA has incorporated an innovative, dynamic portfolio DIY- management (Do it yourself) solution for its clients. This is the Euroclear Quantessence, a new tool that easily allows clients to set and change their portfolios' parameters. This is an effective and neutral platform that provides transactional support to the institutions that need to frequently and automatically rebalance their assets.⁴ Furthermore, the platform reduces cost, time to market, and operational workload by having flexibility, robust infrastructure, and continuous evolution.

3.1.2 Digital Transformation

The concept of digital transformation can be defined as the use of technology to improve the performance or reach of enterprises radically.⁵ Fundamentally, technology tries to provide possibilities for efficiency gains and better customer experience. Still, if the company lacks the right mindset to change the flawed processes, digital transformation will magnify them. There have been plenty of companies who decided to use digital technologies to integrate their existing business capabilities and grew because of it; For example, LEGO developed an engagement platform to supplement its enterprise systems with the ability to interact

⁴ (Martinez, 2019)

⁵ (Bounfour, 2016)

with customers.⁶ Also, companies like BBVA have taken advantage of digital transformation and have significantly impacted their businesses.

Figure 2 Impact of transformation

The impact of transformation



Author: Bank BBVA

Source: <https://www.bbva.com/en/bbvas-digital-transformation-delivering-the-results/>

3.1.3 BPMN

BPMN (Business Process Modeling Notation) is a flowchart that models the steps of a planned business process from end to end. This is to create a standardized bridge

⁶ (Sebastian, Mocket, Ross, Monley, Beath, Fonstad, 2017)

for the gap between the business process design and process implementation.⁷ It is used by depicting four element types for business process diagrams:

- Flow objects: Activities, Gateways, and Events.
- Connecting objects: Sequence flows, message flows, and associations.
- Swimlanes
- Artifacts: Annotations, Groups, and data objects.

Various software types are used to design and simulate the processes being worked on, although the most commonly used is Bizagi. Other examples are Lucidchart, BPMN.io, Adonis, BeePMN.

3.1.4 Robotic Process Automation

Robotic Process Automation (RPA) is a technology that allows developers to configure a "robot" to mimic the actions of a human to execute rules-based business processes. One can say, "An RPA tool operates by mapping a function in the RPA tool language for the software robot to follow, with runtime allocated to execute the script by a control dashboard."⁸ This tool aims to reduce employees' efforts and allow companies to save time and money by resolving more critical processes. These processes are usually repetitive tasks such as copy-paste, log into programs, write out emails, and-so-forth.

There are currently vendors available in the market like Automation Anywhere, Blue Prism, UiPath, AutomationEdge that only sell RPA software; however, other vendors such as Pegasystems and Cognizant have implemented RPA functionalities into their software. The price to implement this kind of software can cost more than \$6,500 USD annually per robot.⁹ Hence a couple of criteria suggested by SolveXia can be taken upon to determine if a process should be automated with RPA:¹⁰

- Are run frequently
- Take a large amount of "manual time" to complete
- Takes more than ten steps to complete
- Have a high cost of error
- Contains high confidentiality information, and an audit trail needs to be maintained

⁷ (White, 2004)

⁸ (TornBohm, Dunie 2017)

⁹ (TornBohm, Dunie 2017)

¹⁰ (SolveXia, 2015)

3.2 Conceptual Framework

3.2.1 Forward contract

One of the most frequent forms of derivatives is the *forward contract*, which is a private agreement between two parties specifying that on an established date in the future, one party will be obligated to purchase the assets from the other party for a pre-established value.¹¹ This form of the derivative is usually utilized to stabilize the revenues costs of business operations.

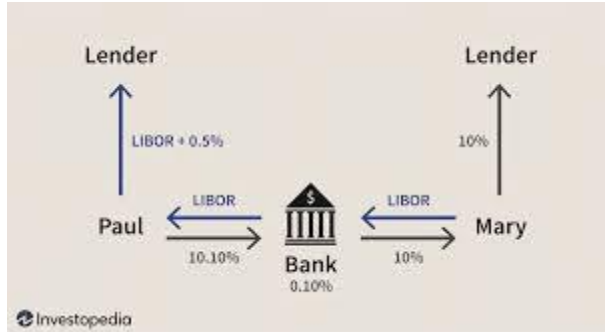
3.2.2 Option contract

The second most common form of derivatives is the *Option contract*, an agreement between a buyer and a seller that gives both parties the *right* or the option to buy or sell the asset at a later date with an agreed-upon price. This contract itself does not obligate either party to fulfill the agreement that was initially agreed upon; however, if neither party does not act upon by the designated date, the option contract expires. The mentioned acts as an essential tool as it permits both parties to study the market before committing.

3.2.3 Swap

Swaps are another common form of derivatives whose market is dominated by financial institutions and firms. These swaps are customized financial contracts between two parties to exchange financial instruments, cash flows, or payments for a certain period with a prearranged format. The "Plain vanilla" swap is considered the most common and most straightforward swap; it consists of a floating interest rate to be exchanged for a fixed rate.

¹¹ (Kwok 2010)

Figure 3 Swaps

Author: Julie Bang

Source: <https://www.investopedia.com/articles/investing/052915/different-types-swaps.asp>

3.2.4 Foreign exchange

Foreign exchange is a global market that is used to exchange or trade different currencies. The market includes all types of aspects of buying, selling, and exchanging these currencies 24 hours a day, seven days a week. Thanks to technology developments and self-service options that have been arising in the past decade, there has been a massive increase within this market, since customers or companies can do these types of transactions from the comfort of wherever they would like, not only during business hours.¹²

¹² (Semple, 2018)

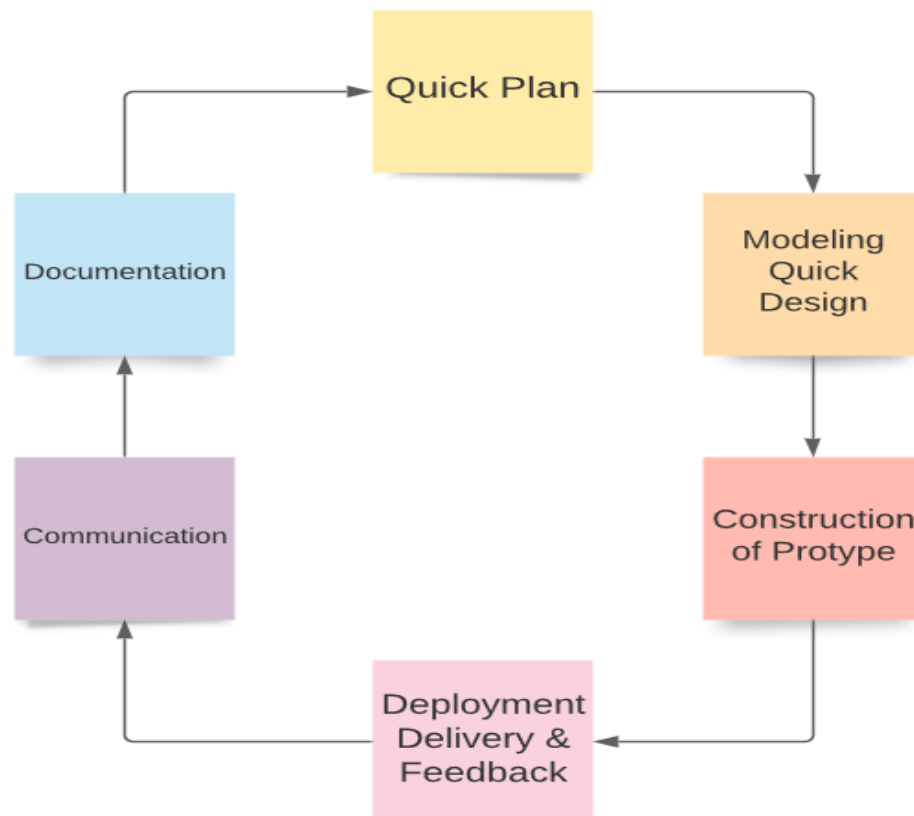
4. Scope and limitations

Initially, this study will confine itself to designing software that will bring some of the manual processes done at the bank through its digital transformation. The functional and non-functional requirements and the use cases that describe the user interaction that the software must provide will be included. A proof of concept that the final design will be adequate to improve what the bank currently has at its disposal. However, due to only having 16 weeks and because of bank policies, a demo or prototype will not be part of the final delivery as there will be sensitive information that could compromise the bank's security guidelines and in-depth the core of the business itself.

5. Methodology

By taking a considerate look at what methodology to use, it was decided to apply a combination of Agile and Prototyping since both involve making incremental improvements over multiple iterations. It must be pointed out that these methodologies are not the same; after all, Prototyping involves iterating around the design and planning phase while Agile focuses on the development phase allowing for any type of feedback on the development of the software before committing to the utter completion of the final product. Teamwork should be emphasized with these methodologies since the iterations around the software are short, only to take a couple of days.

Figure 4 Prototyping Methodology



Author: Roger S. Pressman

Source: https://www.researchgate.net/figure/Gambar-2Model-PrototypePressman-2010_fig1_327719365

The Prototyping methodology, as shown in Figure 3, has five stages in software development¹³:

- Communication: This phase is the starting point since the individual meets the stakeholders to define the software's overall objectives. Typically, all the brainstorming ideas of how the stakeholders want the software to work will be described in this phase.¹⁴
- Quick plan and quick design: These phases consist of making a swift strategy to get a small demo delivered. Then details are modeled quickly to represent windows or layouts in the front-end part of the software.¹⁵
- Construction of Prototype: This phase includes making a small demo that will simulate some of the activities or processes that the software will perform.¹⁶
- Deployment Delivery and Feedback: In this stage, the proposed software will be presented to the stakeholders, who will provide feedback for future improvements to the working demo.¹⁷
- Documentation: This phase provides an overview of the system, it generally describes the software's development and use.

After each iteration, the current prototype will be refined until all the stakeholders' requirements are met, and they are satisfied with the final version of the software.

¹³ (Pressman Roger, Maxim Bruce, 2015)

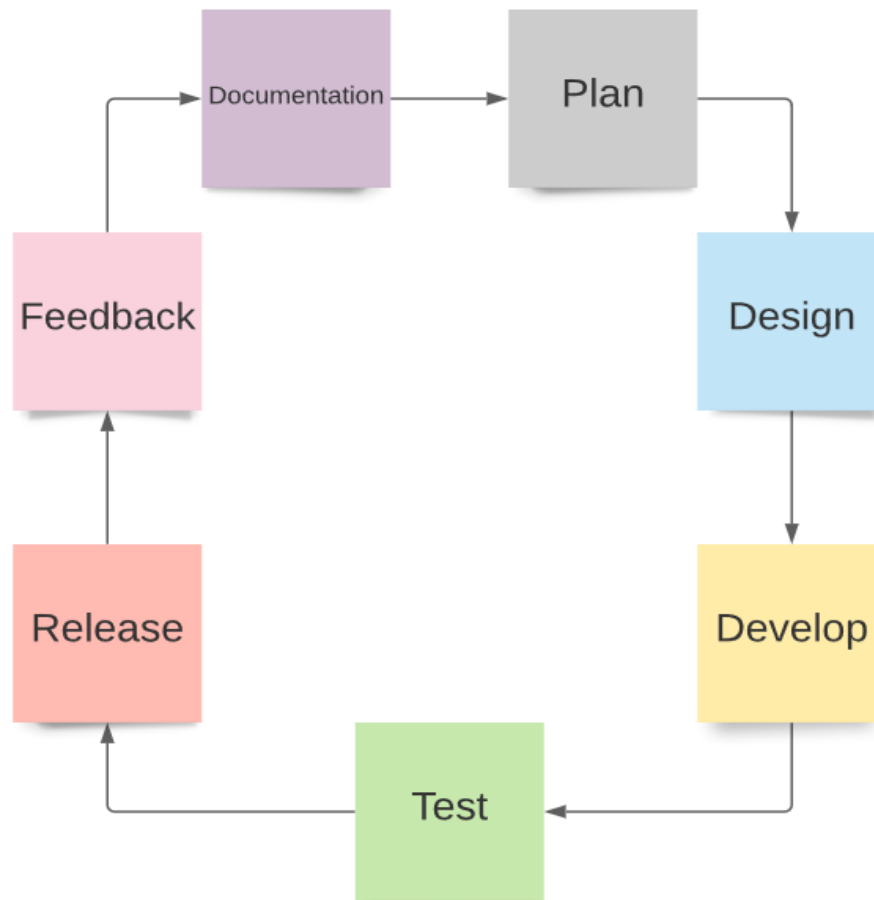
¹⁴ (Pressman Roger, Maxim Bruce, 2015)

¹⁵ (Pressman Roger, Maxim Bruce, 2015)

¹⁶ (Pressman Roger, Maxim Bruce, 2015)

¹⁷ (Pressman Roger, Maxim Bruce, 2015)

Figure 5 Agile Methodology



Author: Encarna Abellan

Source: (Abellan, 2020)

The phases of the Agile methodology are completed within 2-4 weeks each iteration, as shown in Figure 4 and detailed in the following manner:¹⁸

- Plan: This step begins the project by defining the objectives and service specifications with the main stakeholders to verify that the idea is deemed applicable. Afterward, the user stories are created as a lightweight approach to writing down brief descriptions of the needed parts and pieces. Additionally, the team of developers estimates their work based on points.¹⁹

¹⁸ (Ambler Scott, Holitza Matthew, 2012)

¹⁹ (Ambler Scott, Holitza Matthew, 2012)

- Design: This stage is set in motion once the team has defined requirements, and they start working with user experience designers to create a mock-up of the user interface. Simultaneously, the group discusses how to tackle the requirements and propose which tools will be used to achieve the best results.
- Development: This phase converts design documentation into actual working software.²⁰
- Test: The Quality Assurance team spends their time making sure that the software does not have any bugs and business goals have been satisfied through a series of tests.²¹
- Release: The software is installed and delivered to the customer for actual use or production testing within a controlled environment.²²
- Feedback: Allows stakeholders to provide feedback on the product received and allows the developers to start planning out any future iterations.²³
- Documentation: This phase provides an overview of the system, it generally describes the software's development and use.

5.1 Planning and Analysis

In this stage, the project plan and schedules should be defined after understanding the whole background on what exact solution the end-user will like. The user stories, functional and non-functional requirements will be identified since it is essential to look at the whole process around solution delivery. Product roadmaps will also be implemented since they are a common practice within the agile industry. "This will help to decide what road is going to be the best to take, and it will help to figure out how to get there."²⁴

²⁰ (Ambler Scott, Holitza Matthew, 2012)

²¹ (Ambler Scott, Holitza Matthew, 2012)

²² (Ambler Scott, Holitza Matthew, 2012)

²³ (Ambler Scott, Holitza Matthew, 2012)

²⁴ (Layton, 2015)

6. Requirement Analysis

Since the Analyst or the intern must realize this task manually, it was decided by the project manager to automate the process as the times were inefficient.

Within the project stage, as an excellent habit for a successful software project, it was decided to define the functional and non-functional requirements before anything could start. Not only are the requirements going to be stated down below, but they will be broken-down with Epics and User stories to ensure the usability and effectiveness that the software is indeed optimal.

Table 1 Functional Requirements

The System will download the .pt files from Superfinanciera's website
The System will verify that the type of document that was downloaded fits within the categories
The System will verify the dates that the document was uploaded
The System will check that the document is correct
The System will store the date, the type of document, and the code of the form within a separate document
The System will send an email to the bosses with the current report
The System will store the content of the files if the correct file is found
The System will log in to Superfinanciera's website

Author: Juan Cortes

Table 2 Non-Functional Requirements

The System will store the files that were downloaded from the website within a specific folder
User can start access documents that are stored
User will be able to update password every time that is changed
User will be able to review the content of the files that were stored
The System will be user-friendly

The System will notify the user in case of any errors
The System will have a lower time while doing this task

Author: Juan Cortes

Table 3 User story 1

Logging into website		
Number: 1	User: Business Analyst / Intern	
Story Name: Logging into the website		
Business Priority: Must Have		Development risk: Medium
Estimated points: N/A		Iteration assigned: 1
Programmer Responsible: Juan Cortes		
Description: As a Business Analyst/ Intern, I want to log into the Superintendencia's website so that I can verify which files were uploaded.		
Validation: The Analyst/ Intern will be able to log into the website; otherwise, they will get a credential error.		

Author: Juan Cortes

Table 4 User story 2

Verifying the content within files		
Number: 2	User: Business Analyst / Intern	
Story Name: Downloading the files		
Business Priority: Must Have		Development risk: Medium
Estimated points:		Iteration assigned: 1
Programmer Responsible: Juan Cortes		
Description: As a Business Analyst/ Intern, I want to be able to download the files that were uploaded so that I can verify the content of each file.		
Validation: The Analyst/ Intern will be able to see an arrow down icon to download the file; if the file is not available, there will be an "X" icon.		

Author: Juan Cortes

Table 5 User story 3

Verifying the content within the files		
Number: 3	User: Business Analyst / Intern	
Story Name: Verify document information		
Business Priority: Must Have		Development risk: low
Estimated points:		Iteration assigned: 1

Programmer Responsible: Juan Cortes
Description: As a Business Analyst/ Intern, I want to verify the file's content so that I can ensure it was uploaded correctly to the superfinanciera's website.
Validation: The Analyst/ Intern will see "Validation of the information is correct" if the file's content was correctly uploaded.

Author: Juan Cortes

Table 6 User story 4

Keeping a record of the report		
Number: 4	User: Business Analyst / Intern	
Story Name: Copy certain information from the file		
Business Priority: Must Have		Development risk: low
Estimated points:		Iteration assigned: 2
Programmer Responsible: Juan Cortes		
Description: As a Business Analyst/ Intern, I want to copy the number of the file, the type of report, date of the report, date and hour uploaded, and result of the transmission so that I can keep a separate record book.		
Validation: The Analyst/ Intern will copy the number of the file, the type of report, date of the report, date and hour uploaded, and result of the transmission to a different file so they can keep their records of the files that were uploaded.		

Author: Juan Cortes

Table 7 User story 5

Keeping Bosses up to date		
Number: 5	User: Business Analyst / Intern	
Story Name: Sending an email		
Business Priority: Must Have		Development risk: low
Estimated points:		Iteration assigned: 2
Programmer Responsible: Juan Cortes		
Description: As a Business Analyst/ Intern, I want to send an email to the bosses with a list of the uploaded files so that I can keep them aware that everything is fine.		
Validation: The Analyst/ Intern will send an email to the boss with the content needed.		

Author: Juan Cortes

Table 8 User story 6

Keeping a record of the report		
Number: 6	User: Business Analyst / Intern	
Story Name: File the document		
Business Priority: Could be		Development risk: low
Estimated points:		Iteration assigned: 2
Programmer Responsible: Juan Cortes		
Description: As a Business Analyst/ Intern, I want to find the document that was downloaded within a folder so that I can reopen it in the future if needed.		
Validation: The Analyst/ Intern will be able to find and reopen the file after the verification process is completed.		

Author: Juan Cortes

Table 9 User story 7

Notification of errors		
Number: 7	User: System	
Story Name: Notifying errors		
Business Priority: Could be		Development risk: High
Estimated points:		Iteration assigned: 3
Programmer Responsible: Juan Cortes		
Description: As a system, I want to notify the business analyst/intern of any errors that may be produced while proceeding with the process so that I can complete the task without any issues.		
Validation: The System will notify the business analyst through a message if any errors come up or if it cannot complete the process.		

Author: Juan Cortes

Table 10 User story 8

Updating password		
Number: 8	User: Business Analyst / Intern	
Story Name: Changing the password		
Business Priority: Could be		Development risk: Medium
Estimated points:		Iteration assigned: 3
Programmer Responsible: Juan Cortes		
Description: As a Business Analyst/ Intern, I want to update the password to log into SuperFinanciera's website so that I can make sure the process gets completed.		

Validation:
The Analyst/ Intern will update the password once it has changed so the process can be completed.

Author: Juan Cortes

Table 11 Product Backlog for Automation of the control of regulatory forms

Product Backlog for Automation of the control of regulatory forms		
Task ID	User Story	Priority
1	As a Business Analyst/ Intern, I want to log into the Superintendencia's website so that I can verify which files were uploaded.	1
2	As a Business Analyst/ Intern, I want to be able to download the files that were uploaded so that I can verify the content of each file.	2
3	As a Business Analyst/ Intern, I want to verify the content of the file so that I can make sure that it was uploaded correctly to the superfinanciera's website.	3
4	As a Business Analyst/ Intern, I want to copy the number of the file, the type of report, date of the report, date and hour uploaded, and result of the transmission so that I can keep a separate record book.	4
5	As a Business Analyst/ Intern, I want to send an email to the bosses with the documents' content so that I can keep them aware that everything is fine.	5
6	As a Business Analyst/ Intern, I want to rename the file with the date that it was uploaded and file the document within a specific folder so as not to have to organize it.	6
7	As a system, I want to notify the business analyst/intern of any errors that may be produced while proceeding with the process so that I can complete the task without any issues.	7
8	As a Business Analyst/ Intern, I want to update the password to log into SuperFinanciera's website so that I can make sure the process gets completed.	8

Author: Juan Cortes

Table 12 Acceptance Criteria

Task ID	Acceptance Criteria
1	Business Analyst/Intern can see the Module of reception of information.
2	Business Analyst/Intern can see the downloaded file in the "Downloaded Files" Folder.

3	Business Analyst/Intern can open the *.PT file with Wordpad and will be able to see the number of the document, the type of report, the date that it was uploaded.
4	Business Analyst/Intern can consult the information that was copied within a *.CSV file.
5	Business Analyst/Intern can find the email sent in the "Sent" folder within the email interface.
6	Business Analyst/Intern can review the files in their respective folder while having their name changed.
7	Business Analyst/Intern will see a message if any error shows up while running the process
8	Business Analyst/Intern can view a message that the password was updated correctly.

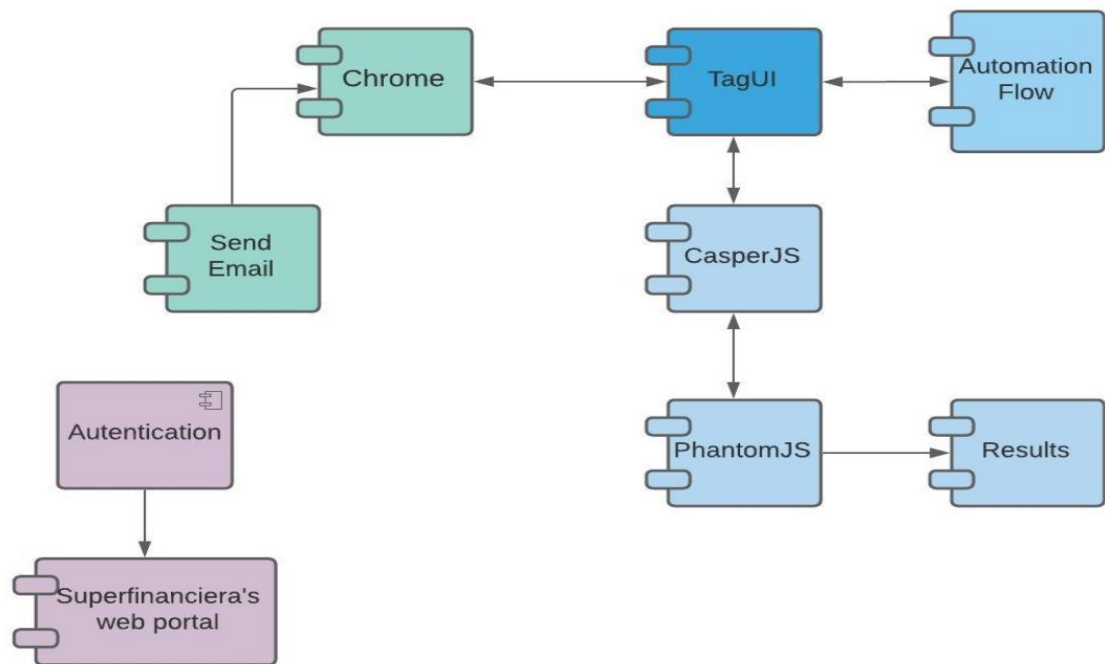
Author: Juan Cortes

7. Software Design

To fulfill business expectations, a software architecture was designed by using different views consisting of a component diagram, a deployment diagram, a context diagram, and a BPMN diagram.

The component diagram was designed to describe that the system's functionality is acceptable, as shown in the following figure 5:

Figure 6 Component Diagram



Author: Juan Cortes

TagUI, which is the RPA that was chosen as the building block to complete the fulfillment of the software, works with different components such as CasperJS, Google Chrome, and the Automation Flow to provide the outcome of automizing the function without any complication. TagUI works with these components in the following way:

CasperJS allows building full navigation scenarios using high-level functions and a straightforward interface to accomplish common everyday tasks. It also captures data from web pages that do not contain APIs. This component works directly with

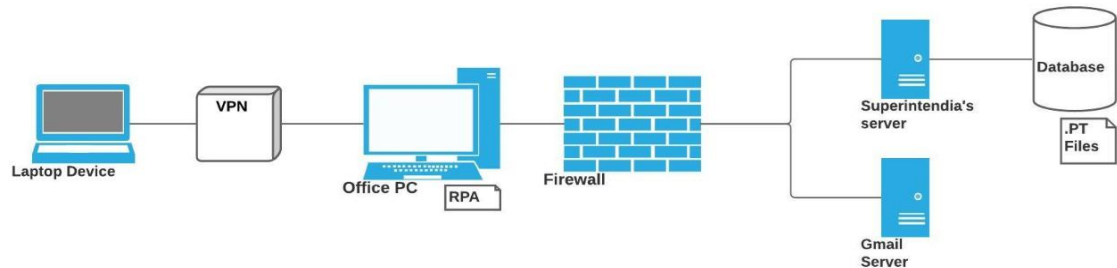
PhantomJS. Together with TagUI, it instantly converts flow from different native natural languages into working JavaScript UI automation code.

PhantomJS is a headless WebKit scriptable with JavaScript that allows access and manipulation of web pages. It uses CasperJS as the testing utility. Since PhantomJS can load and manipulate web pages, it is the best option for automating any type of interaction without having to open a browser.

The Automation Flow allows developers to write manually in different native languages and passes it on to TagUI. Meaning that the developer does not have to write the code only in the English language but can do it in any other language that they chose, or they can create their language CSV files that contain the syntax that they would prefer.

Chrome allows to visually see the process that TagUI is building in the background. It can be chosen to use either the headless browser, which is typically used when testing or the "real browser." Since TagUI works for both Mac and Linux operating systems, either Safari or Firefox could be used; however, Google Chrome is the preferred browser to be used directly at the BBVA.

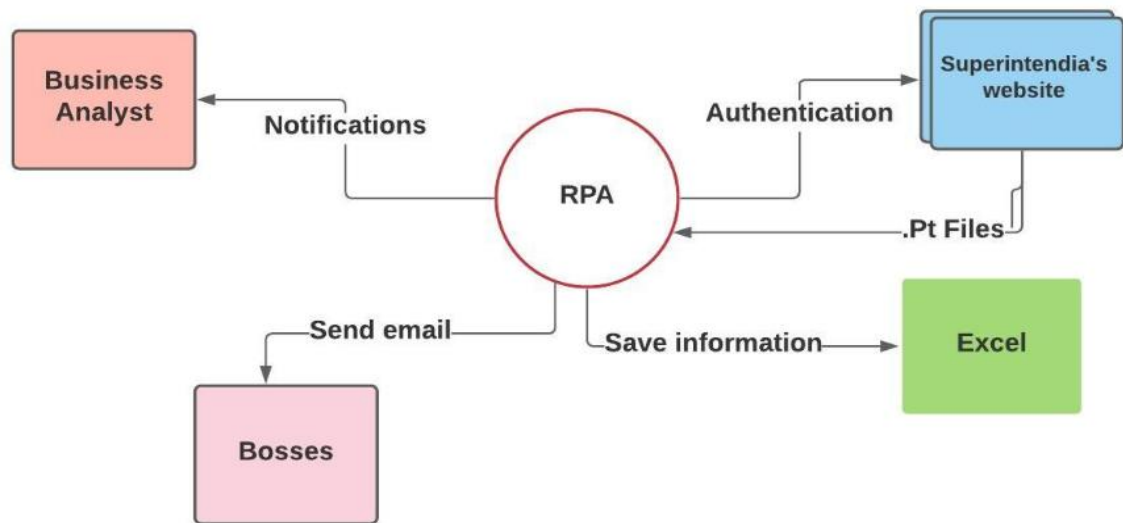
Figure 7 Deployment Diagram



Author: Juan Cortes

The Deployment diagram shows how the system has to be deployed. This specific diagram consists of a laptop, which the bank provided to access its network through Sonicwall VPN directly. Once securely connected, full remote access will be provided to control an office computer with the RPA installed. There is a need to be connected to the Superintendencia's server, which has the *.PT files within their database, the petition will need to cross the bank's firewall to connect successfully. Concurrently there is also a need to connect to the Google email server, either to send an email with the information collected during the control or to have communication with the bosses since it is the most reliable way to get in touch with them.

Figure 8 Context Diagram



Author: Juan Cortes

The context diagram "aims to answer questions about the environment and specifically the technical relationship that the system being designed has with the various elements of this wider environment."²⁵ With this being stated, the context diagram shows how the RPA interacts with Superintendia's website, Business Analyst, Bosses, and excel. It starts with the RPA doing the authentication process to access the Superintendia's website to permit it to download the files that are required to be validated. After it is finished doing the validation process, it will store the information needed into an Excel file for record-keeping. Once the information is finally stored in the Excel file, an email will be sent to bosses to notify them if further action is needed. In case there is a malfunction in any way, the RPA will inform the Business Analyst what process it was unable to complete.

²⁵ (Wood, Rozanski, 2009)

Figure 9 BPMN Main Process

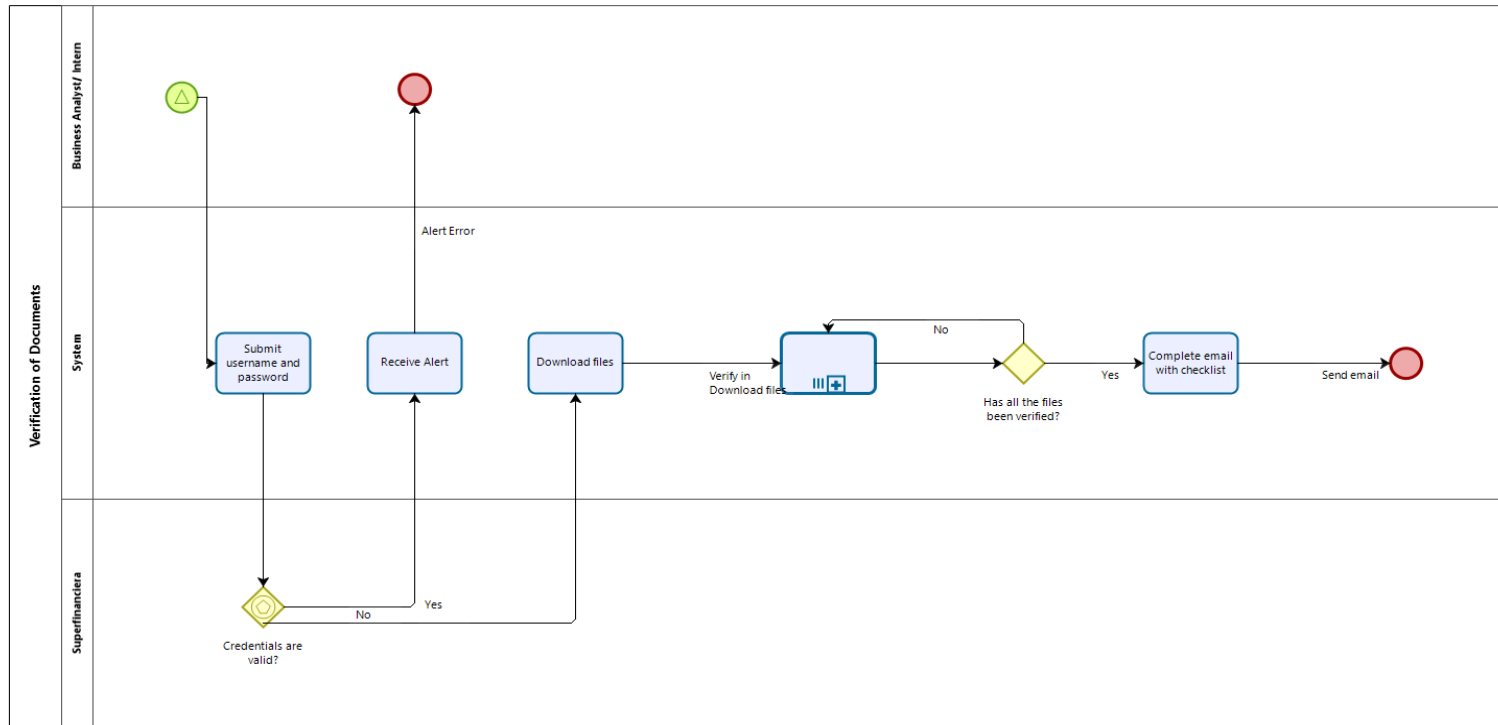
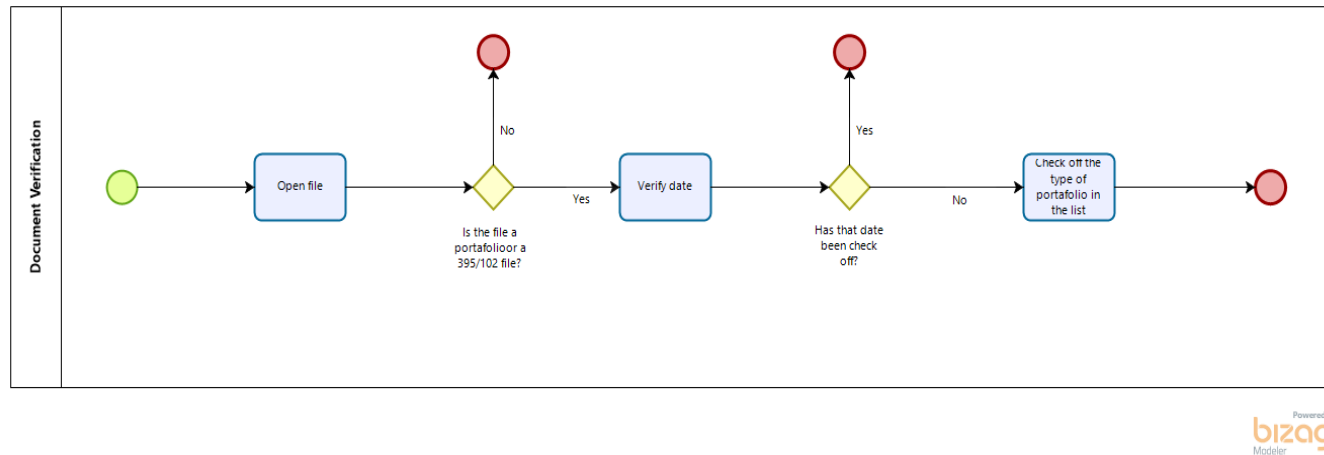


Figure 10 Document Validation Process



Author: Juan Cortes

The whole process starts with the Business Analyst/ Intern initiating the RPA, who submits the username and password to the Superintendencia's website; the website validates this. Once access has been granted, it will download the files that are available to be downloaded. After the download has been completed, the RPA will open the file and validate if the file is either a portfolio or a TCRM (395 or 102 files), and if they are, it will verify if it is a file that is missing on a specific date. Unless the file was already checked off, it will mark-off the date and the type of file currently being under review. It will follow the same routine until there are no more files to be downloaded within Superintendencia's website or if the checklist is up to date, meaning all the files were uploaded correctly. With either scenario happening, an email will be sent to the Bosses with a report in that day's control.

8. Validation of proposed design

Before the whole system was designed, there was a need to look at different RPA software types to choose the one that benefits every party the best. There was a consideration between commercial and open-source software since there is a need to install the software within the office desktop.

The following table of comparison shows how TagUI was the software chosen to complete the implementation:

Table 13 Table of Comparison

	UiPath		Automation Anywhere		Robocorp		TagUI	Weighted Value	Percentage Value
Windows	X	15	X	15	X	15	X	15	15%
Mac		0		0	X	5	X	5	5%
Linux	X	5	X	5	X	5	X	5	5%
Code-free environment	X	5		0		0		0	5%
Cloud-based environment	X	2.5		0	X	2.5		0	2.5%
Visual automation	X	2.5	X	2.5			X	2.5	2.5%
Attended Automation	X	20	X	20	X	20	X	20	20%
Unattended Automation	X	5		0				0	5%
Open Source*		0		0	X	15*	X	30	30%
Documentation	X	10	X	10	X	10	X	10	10%
Total	65		52.5			72.5		87.5	100%

Author: Juan Cortes

(*) Robocorp is open software; however, there are only 200 minutes of usage per month before paying for a license, which cuts the percentage value by half.

All the features found on the left-hand side of each software were considered the center of analysis. These were given a percentage value as there were things to consider, such as the bank's security policies, costs, operating systems, and the software's full documentation availability.

After selecting which software and then designing the software architecture that was going to be used as the building block to automizing the manual process, the development phase was started.

Since TagUI has a Python implementation, the software was developed in that language.

The following figures will demonstrate how far the development of the software got to. Comparing it to the acceptance criteria will ensure that the proposed design is efficient to be used as an alternative to manually completing the function.

Acceptance Criteria

Task ID	Acceptance Criteria
1	Business Analyst/Intern can see the Module of reception of information.
2	Business Analyst/Intern can see the downloaded file in the "Downloaded Files" Folder.
3	Business Analyst/Intern can open the *.PT file with Wordpad and will be able to see the number of the document, the type of report, the date that it was uploaded.
4	Business Analyst/Intern can consult the information that was copied within a *.CSV file.
5	Business Analyst/Intern can find the email sent in the "Sent" folder within the email interface.
6	Business Analyst/Intern can review the files in their respective folder while having their name changed.
7	Business Analyst/Intern will see a message if any error shows up while running the process
8	Business Analyst/Intern can view a message that the password was updated correctly.

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Task ID 1:

The System was able to log in to the superintendencia's website, and the Business Analyst/Intern can validate that the password and username were input correctly since the website did not provide any error as shown in the following Figures 10 and 11:

Figure 11 Login Process

The screenshot shows the login interface of the Superintendencia Financiera de Colombia (SFC). The header includes the SFC logo, the text "Superintendencia Financiera de Colombia", and logos for "MINHACIENDA" and "GOBIERNO DE COLOMBIA". A blue navigation bar contains a gear icon, the text "Módulo de recepción de información:: Superintendencia Financiera de Colombia", a red star icon labeled "Inicio", and a lock icon labeled "Ingreso". The main content area features the SFC logo and a description: "Recepción de información :: módulo para la recepción de la información enviada por los vigilados de la Superintendencia y para la verificación de su estado de procesamiento." Below this is a login form with fields for "Usuario" and "Clave", a checkbox for "Recordar usuario en este equipo?", and an "Ingresar" button.

Author: Juan Cortes

Figure 12 Login Successful

The screenshot shows the dashboard after a successful login. The header and navigation bar are identical to Figure 11. The main content area displays a welcome message "Bienvenido usuario" and a list of operations: "Recepción de información :: módulo para la recepción de la información enviada por los vigilados de la Superintendencia y para la verificación de su estado de procesamiento. En este módulo, el usuario vigilado podrá llevar a cabo las siguientes operaciones." The operations listed are "Verificar el estado de procesamiento" and "Enviar información".

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Task ID 2:

In this Task ID, the system downloads every file and internally opens and validates the information given. Each downloaded file can be found in the path "C:/Users/juanc/Documents/". This process can be seen in the following figures 12 and 13 as the RPA starts from the bottom, considering that the older files are at the bottom:

Figure 13 RPA starts validation

The screenshot displays a web application interface. At the top, there is a table with columns for ID, Description, Date, Status, and Action. The table contains several rows of data, including entries for 'Informes entidades bancarias' and 'Medidas Especiales'. Below the table, there is a navigation bar with buttons like 'Inicio', 'Listar', 'Agregar', and 'Eliminar'. To the right of the table, there is a sidebar with a search bar and a list of filters. Below the table, there is a section titled 'Superintendencia Financiera de Colombia - V.4.7.0 - 2020-07-02' with contact information and a download link. The browser window shows the URL 'superfinanciera.gov.co/SuperfinancieraArchivos/user/downloadServlet.do?id...' and a list of files in the background.

ID	Descripción	Fecha	Estado	Acción
52483511	Informes entidades bancarias	Friday, November 13, 2020 2:09:19 PM	Información procesada con éxito	[Icono de éxito]
52483481	Informes entidades bancarias	Friday, November 13, 2020 2:03:16 PM	Información procesada con errores	[Icono de error]
52483478	Informes entidades bancarias	Friday, November 13, 2020 2:02:20 PM	Información procesada con éxito	[Icono de éxito]
52483474	Informes entidades bancarias	Friday, November 13, 2020 2:01:57 PM	Información procesada con errores	[Icono de error]
52483319	Informes entidades bancarias	Friday, November 13, 2020 12:29:03 PM	Información procesada con éxito	[Icono de éxito]
52482998	Medidas Especiales	Thursday, November 12, 2020 10:33:03 AM	Información procesada con éxito	[Icono de éxito]
52482997	Medidas Especiales	Wednesday, November 11, 2020 10:32:31 AM	Información procesada con éxito	[Icono de éxito]
52482702	Informes entidades bancarias	Friday, November 13, 2020 8:34:05 AM	Información procesada con éxito	[Icono de éxito]
52482659	Informes entidades bancarias	Friday, November 13, 2020 8:16:29 AM	Información procesada con éxito	[Icono de éxito]
52482316	Informes entidades bancarias	Thursday, November 12, 2020 7:45:01 PM	Información procesada con éxito	[Icono de éxito]

Superintendencia Financiera de Colombia - V.4.7.0 - 2020-07-02
 Calle 7a No. 4-49
 Correo: (571) 594 02 00 - 594 02 01 - Fax (571) 350 79 99 - 350 5707
 Centro de Contacto: 419-7100 Recibe consultas e inquietudes sobre los diferentes servicios que presta la Superintendencia Financiera de Colombia. Este servicio opera de 7:30 a.m. a 5:30 p.m. en jornada continua.
 Los temas relacionados con la transmisión de información de las entidades vigiladas, se atenderán a través de la línea 5940200/01 Opción 5.
 Punto de contacto: Lunes a Viernes de 8:15 a.m. a 4:15 p.m. Jornada continua
 Línea Gratuita Nacional 018000 120 100
 Horario de Atención al Público: Lunes a Viernes de 8:15 a.m. a 4:45 p.m. Jornada Continua

superfinanciera.gov.co/SuperfinancieraArchivos/user/downloadServlet.do?id=...

52482998_DROC_O...val 52482997_DROC_O...val 52482702_001_0000...p 52482659_001_0000...p

Author: Juan Cortes

Figure 14 Location of Files

The screenshot shows a Windows File Explorer window with the address bar set to 'Users > juanc > Documents'. The left sidebar shows the 'Documents' folder selected. The main pane displays a list of files with columns for Name, Date modified, Type, and Size. The files are listed in descending order of date modified. The file 'Derivados.csv' is selected.

Nombre	Fecha modificada	Tipo	Tamaño
52482998_DROC_OficinasDiario_20201112_001...	11/16/2020 8:08 PM	VAL File	1 KB
52483319_001_000013.pt	11/16/2020 8:09 PM	PT File	3 KB
52483474_001_000013.pt	11/16/2020 8:09 PM	PT File	5 KB
52483478_001_000013.pt	11/16/2020 8:09 PM	PT File	3 KB
52483481_001_000013.pt	11/16/2020 8:09 PM	PT File	4 KB
52483511_001_000013.pt	11/16/2020 8:09 PM	PT File	3 KB
52483526_001_000013.pt	11/16/2020 7:39 PM	PT File	3 KB
52483779_001_000013.pt	11/16/2020 7:39 PM	PT File	3 KB
0052484798_0001_000013_0000_000000_0000...	11/16/2020 7:39 PM	P7Z File	3 KB
0052484963_0001_000013_0000_000000_0000...	11/16/2020 7:39 PM	P7Z File	3 KB
0052484978_0001_000013_0000_000000_0000...	11/16/2020 7:39 PM	P7Z File	3 KB
Automation.ipynb	11/16/2020 8:09 PM	IPYNB File	26 KB
Derivados.csv	11/16/2020 8:09 PM	Microsoft Excel Com...	1 KB

62 items 1 item selected 190 bytes

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Task ID 3:

Figure 14 presents the information that the system is reading and writing into the *.CSV file; this specific feature will be left untouched, allowing the Business Analyst/Intern to view the information that the system is reading and working.

Figure 15 *.PT File

```

TIPODEINFORME 0 Portafoliode
FECHA DEL INFORME .....: 12112020
FECHA Y HORA DE ENVIO .....: 13112020-14:03
RESULTADO DE LA TRANSMISION ....: VALIDACION DE INFORMACION ERRADA

TIPODEINFORME 2
FECHA DEL INFORME .....: 12112020
2020-11-12
FECHA Y HORA DE ENVIO .....: 13112020-14:14

```

Author: Juan Cortes

Task ID 4:

Suppose the Business Analyst/ Intern were to open up the *.CSV file, where the system stores the information needed after validating the documents (need to consider that this file cannot be opened until the process is complete). In that case, they will be able to see the following information, as shown in Figure 15:

Figure 16 *.CVS File

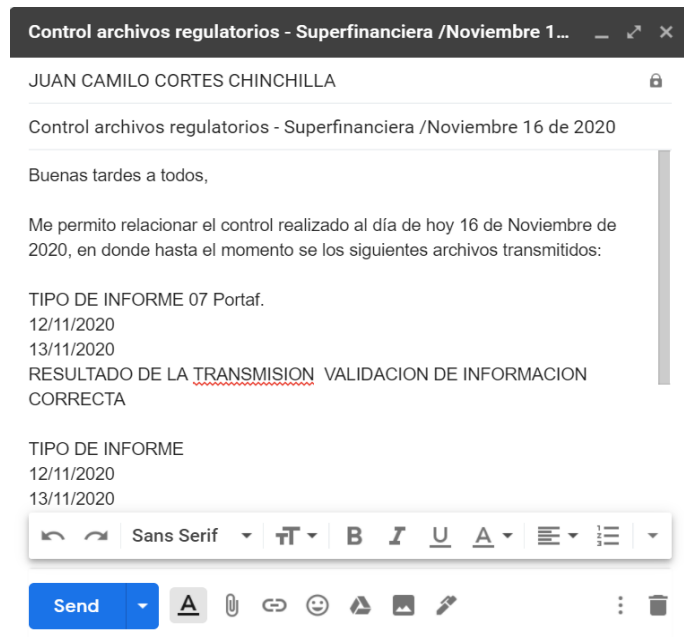
TIPO DE INFORME 7	TIPO DE INFORME 2
12-Nov-20	12-Nov-20
13-Nov-20	13-Nov-20
RESULTADO DE LA TRANSMISION VALIDACION DE INFORMACION CORRECTA	RESULTADO DE LATRANSMISION VALIDACION DE INFORMACION CORRECTA

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Task ID 5:

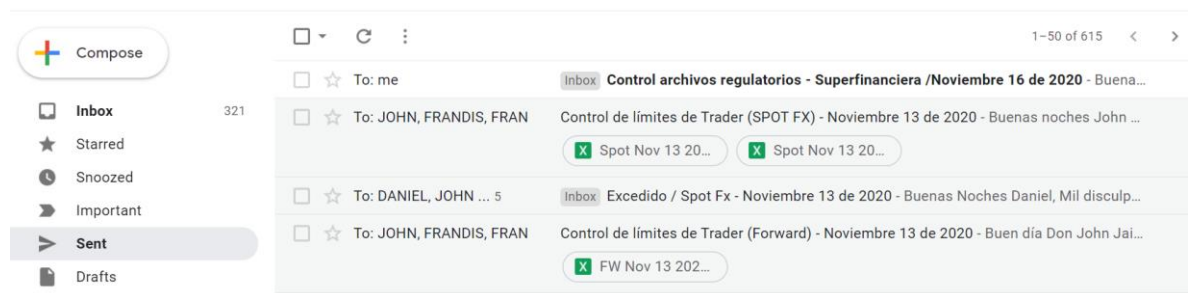
As the acceptance criteria for Task ID 5, the system must write out an email with the content such as the one found within the *.CSV file and then send it to the bosses. After finishing with the validation of the files found on the Superintendencia's website, the system will log into Gmail. Following that step, the system will write out the email, as shown in Figure 16, and that email will be seen in the Sent folder after the email is sent to the bosses, as shown in Figure 17:

Figure 17 Email being written out



Author: Juan Cortes

Figure 18 View of Sent Folder



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9. Conclusion

The entire system was modeled with the Functional and Non-functional requirements as they were defined and built into user stories to answer whatever questions came up to match the Business Analyst's perspective. These steps helped to replicate the direction in which the system's flow is supposed to take. Simultaneously, the acceptance criteria for each of the user stories were defined to evaluate the effectiveness of what the software could do once it was finished. Nevertheless, combining both tools permit the entire software to have the usability and effectiveness to transition from a manual task to an automated process.

The use of view and views as a reference model allowed to define a software architecture with the following diagrams: Context, Deployment, and Component. The diagrams themselves describe the relationships, dependencies, and interactions between the system and its environment. Furthermore, it shows the environment into which the system will be deployed and its runtime components. Those mentioned earlier allowed to view how the bank's environment was set up. It should also consider what kind of relationships the RPA would have needed to be involved between components and its environment.

After analyzing and studying to what extent the RPA TagUI software can reach, it is safe to say it is an excellent tool to work with. While judging as it is open software, there could have been many limitations in the communication between different components. However, using Python as an alternative, all these possible issues were significantly reduced as it is a robust, high-level programming language with many adaptabilities. Also, since the program is written out in a combination of Python's and TagUI's native languages, there was more support than expected within different blogs to fulfill the software's functionality.

Furthermore, undoubtedly by using the software designed within this document, the function that the Business Analyst/Intern had to do manually every day was cut drastically to the point that it took between 5-10 minutes to complete. These values vary due to the Money Market department does not upload all the files on the same day but can instead upload all files within the time limit that the Superintendencia provides of two business days.

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